An Empirical Study on Female Participation in Software Project Courses

Extended Abstract

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Abstract—Gender issues in software engineering education are gaining research attention due to the desire to promote female participation in the field. The objective of this work is to enhance the understanding of female students' participation in software engineering projects to support gender-aware course optimization. Since 2015, we have investigated the participations of female students in terms of software engineering activities and team dynamics in a software project course that involves a real customer. We found that female students are more active with project management and requirement engineering, while they remain under-represented in highly complex or specific tasks, i.e. architecture work, and user experience design. We found no statistically significant difference in perceived team dynamics between male and female students. Insights on female project activities would facilitate the arrangement of project teams so that learning can be distributed equally across genders.

Keywords— female participation, gender, software engineering project course, mixed approach research

I. INTRODUCTION

While there is no consensus in software engineering education regarding what a software project course should cover, the importance of such courses is undeniable [1]. The main goal of such a course is to equip students with real-life experience and ultimately reduce the gap between education and industrial demands [2]. The important reward of this academic experience is the development of non-technical skills. Software project course TDT4290 has been taught at the Norwegian University of Science and Technology (NTNU) for more than 40 years [3]. Although the topics covered in the course curriculum change a bit from year to year, the course includes important practical information and is rated as the most important learning experience by Information Technology (IT) students at NTNU.

Researchers are typically concerned with the improvement of student learning from various aspects, such as team processes, customer involvement, project management and leadership [4, 5]. Recently, we became interested in the participation of female students in software project courses. The idea was inspired by the fact that women are underrepresented in the engineering and technology professions [6]. Engineering is a male-dominated field, both in terms of the gender majority and the way in which engineering tasks are framed and valued [6]. Women, may find teamwork in engineering courses to be frustrating and ineffective [7]. Being a minority in a group, female students might be less exposed to varied learning experiences compared to their male peers. For example, female students could be assigned to traditional, nontechnical female roles, such as organizers, secretaries, and writers, whereas men tend to be assigned to more technical roles [6], although both types of roles are important for project success.

Understanding female participation in SE education contributes to improving female students' learning experience during their studies. Appropriate educational approaches would encourage female students' participation in SE as well as their competence and career prospects. Studies have examined female participation in SE education [8,9]. However, knowledge of female activity throughout a software development project is limited. One reason for the lack of investigation of this issue is that female students are often less involved in project work or participate in a modest manner, which makes their learning progresses difficult to observe. In this paper, we briefly present the findings for our research questions: (1) RQ1: What do female students do in software development projects? and (2) RQ2: Does gender appear as a barrier to team dynamics?

II. RESEARCH APPROACH

The goal of course TDT4290 is to teach students "*software engineering skills in the context of a development project to make a realistic prototype of an Information System (IS) "on contract" for a real-world customer*" [10]. Each project has a real customer, typically an industrial company, a research organization or public sectors. Each project team includes six to eight students, self-organized and supervised regularly. We arranged regular supervision to assist the students with the challenges or issues they encountered. Since 2015, we adjusted the course settings to facilitate the study of female participation in our course. We attempted to assign female students to every team and strongly encouraged them to take active positions, i.e. i.e. team leaders or managers. The leader position does not exclude the ability to participate in technical tasks.

Table 1: Number of students in the course

Year	# teams	# male students	# female students
2015	12	69 (87.4%)	10 (12.6%)
2016	13	72 (83.7%)	14 (16.3%)
2017	14	73 (79.4%)	19 (20.6%)
Total	39	214 (83.3%)	43 (16.7%)

At the end of the course, we conducted surveys and interviews to collect the students' opinions on perceived teamwork, team performance, and learning outcomes. Each student team delivered a project report reflection report that provide insights on how each team member worked, their roles, their contributions and what they have learned and what they could have done differently. The identified responsible area from reports and survey responses helps to map female

and male students to their roles and learning area. In total, 39 student teams were studied in depth using a mixed-research approach from 2015 to 2017, as shown in Table 1. Qualitative analysis is conducted with software NVivo and quantitative analysis with IBM SPSS.

III. PRELIMIARY RESULTS

This section presents summarized findings on the participation of female students in software engineering activities (RQ1) and teamwork (RQ2).

A. RQ1: What do female students do software development projects?

Project management- and requirement-related tasks were the most common tasks led by female students, which were performed by 70% and 56% of the female students, respectively. Whether assigned or voluntarily, female students expended considerable effort in coordinating team members and planning and tracking the execution of tasks. Female students were often involved in meetings with customers, participated in taking notes, and created user stories.

A relatively significant number of female students were actively involved in implementation (51% of female students). These students typically took charge of a module (front-end/ backend), which was later integrated into a larger system. Even though every team member was aware of ongoing tasks, what others were doing, and participated in all the tasks, there were only some members of a team that specially focused on a particular task.

A total of 12% and 9% of the female students actively led user experience work (design front-end layout, photos, etc.) and managed the Scrum methodology (i.e., Scrum master, product owner), respectively. Unit testing was often performed by the person who developed the code. The managing integration test, writing test report, test cases, etc. were typically done by male students. Only 7% of the female students actively participated as test managers (i.e. test planning, test execution and test report).

Architecture is the area in which the female students were least active. This includes the technical plan for the whole system and certain specialized technologies (i.e., algorithms, artificial intelligence, system architecture, and security). We only had two cases in which female students actively led architecture activities:

B. RQ2: Does gender appear as a barieer to team dynamics?

Figure 1 depicts boxplots of the students' ranks on team dynamics constructs, showing that students' perceptions are quite stable across constructs of team dynamic, including team decision making, leadership, sefl-reflection and task management. Overall students are satisfied with their team dynamics, with ranking 3.5 or above in all constructs. Except for task management, in which the median value of the female students' ranks is higher than that of the male students' ranks (4 vs. 3.5), males and females share the same median values in perceptions on decision-making, self-reflection, and leadership. We conducted a Mann–Whitney–Wilcoxon test, which showed no significant differences between groups of female and male students
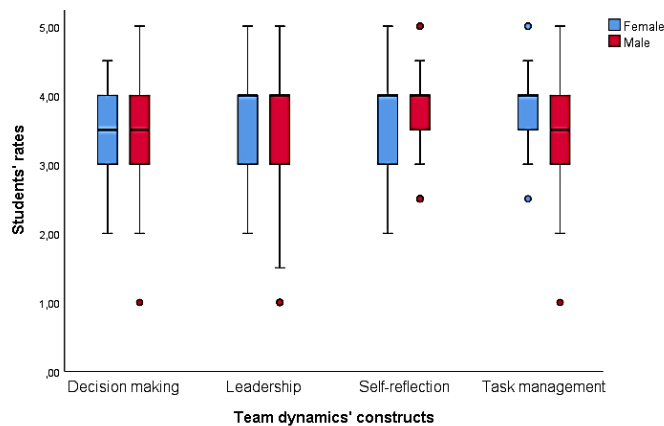

Figure 1: Team dynamics perceived by genders

IV. CONCLUSIONS

This extended abstract summarized some of our findings about female participation in a Norwegian university. In a project course, female students actively involve in project management, requirement engineering, and administration. Even though we found that there is no difference in terms of perceived team dynamics between female and male students, there are overall limited influences on SE activities. A following step in this research would be to investigate other dimensions of team dynamics and their influence on team performance.

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